

Claims

What is claimed

1. A fuel injector comprising:
  - a high-pressure fuel supply line;
  - a fuel cavity,
  - a check control cavity;
  - a check valve at least partially disposed in said fuel cavity and being exposed to a fluid pressure force, in said check control cavity;
  - a control valve moveable between a first position, at which said high-pressure fuel supply line is fluidly connected to said fuel cavity, and a second position, at which said fuel cavity is fluidly connected to said check control cavity, and
  - a low pressure drain line connected to said check control cavity.
2. The fuel injector of claim 1 wherein said low-pressure drain line is directly connected to an at least one of said check control cavity and said check control cavity line.
3. The fuel injector of claim 1 wherein said control valve has a transition location between said first position and said second position in which said fuel cavity and said check control cavity are fluidly connected to said high-pressure fuel supply line.
4. The fuel injector of claim 1 further including:
  - a check piston at least partially disposed in said check control cavity, and said low-pressure drain line being disposed in an at least one of said body, said control valve, and said check piston.

5. The fuel injector of claim 1 further including:  
an orifice in said low-pressure drain line.
  
6. The fuel injector of claim 1 further including:  
a valve member at least partially disposed within said  
control valve, and  
an electrical actuator, being adapted to directly move said  
valve member.
  
7. The fuel injector of claim 6 wherein said electrical actuator  
is a piezo-stack type actuator.
  
8. The fuel injector of claim 6 wherein said electrical actuator  
has an armature;  
said armature being connected to said valve member.
  
9. The fuel injector of claim 1 further including:  
a check piston having a predetermined diameter at least  
partially disposed in said check control cavity;  
said check valve having a predetermined diameter; and  
said predetermined check piston diameter being greater  
than said predetermined check valve diameter.
  
10. The fuel injector of claim 5 further including:  
a check control cavity line fluidly connected to said check  
control cavity and fluidly connected to said low-pressure drain line.
  
11. The fuel injector of claim 10 further including:

a second orifice in said check control cavity line; and wherein said orifice in said low-pressure drain line is smaller than said second orifice in said check control cavity line.

12. A method of operating a fuel injector having a fuel cavity, a check control cavity, and a check valve at least partially, slideably disposed in said fuel cavity and exposable to a pressure force in said check control cavity, comprising:

actuating a control valve; and  
fluidly connecting said fuel cavity to said check control cavity; and

stopping fuel injection by said fuel injector.

13. The method of claim 12 further including fluidly connecting said check control cavity to a reservoir.

14. A method of operating a fuel injector having a fuel cavity, a check control cavity, a check valve at least partially, slideably disposed in said fuel cavity and exposable to a pressure force in said check control cavity, and a control valve moveable between a first position at which high-pressure fuel flows from a high-pressure fuel source to said fuel cavity and a second position at which said high-pressure fuel source is fluidly blocked from said fuel cavity, comprising:

moving said control valve from said second position to said first position through a transition location; and

fluidly connecting said fuel cavity and said check control cavity to said high-pressure fuel source while said control valve is in said transition location.

15. The method of claim 14 further including:  
maintaining said fluid connection between said fuel cavity  
and said high-pressure fuel source and fluidly blocking flow to said check control  
cavity when said control valve is in said first position.
  
16. The method of claim 15 further including fluidly  
connecting said check control cavity to a low-pressure drain line.
  
17. The method of claim 16 further including restricting a flow  
in said low-pressure drain line after fluidly connecting to said check control  
cavity.